

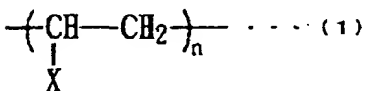
CLAIMS

1. (Amended) A multilayer printed circuit board comprising a substrate board and, as built up on said substrate board successively and alternately, a conductor circuit and a resin insulating layer at a plurality of levels, with said conductor circuits being interconnected by way of via holes, wherein said resin insulating layer is composed of a polyolefin resin.

2. The multilayer printed circuit board according to Claim 1 wherein said polyolefin resin is a thermosetting polyolefin resin or a thermoplastic polyolefin resin.

3. The multilayer printed circuit board according to Claim 2 wherein the thermoplastic polyolefin resin has a melting point of not less than 200°C.

4. The multilayer printed circuit board according to any of Claims 1 to 3 wherein said polyolefin resin is a resin composed of one species of the repeating unit represented by the following chemical formula (1) or a resin comprising a copolymer of two or more different species of the repeating unit represented by said formula (1).

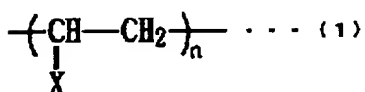


wherein n represents 1 to 10000; X represents a hydrogen atom, an alkyl group, a phenyl group, a hydroxyl group, an unsaturated hydrocarbon residue having 2 to 3 carbon atoms, an oxide group or a lactone group.

5. The multilayer printed circuit board according to any of Claims 1 to 4 wherein said polyolefin resin is a resin which has a repeating unit represented by the following chemical

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formula (1) and contains a double bond, an oxide structure, a lactone structure or a mono- or polycyclopentadiene structure in its backbone chain.



wherein n represents 1 to 10000; X represents a hydrogen atom, an alkyl group, a phenyl group, a hydroxyl group, an unsaturated hydrocarbon residue having 2 to 3 carbon atoms, an oxide group or a lactone group.

6. A multilayer printed circuit board wherein the polyolefin resin is a mixed resin of two or more species of the polyolefin resin according to Claim 4 or 5, a resin composed of two or more polyolefin resin crosslinked to one another according to Claim 4 or 5, or a mixed resin comprising a polyolefin resin selected from the polyolefin resin according to Claim 4 or 5 and a thermosetting resin.

7. The multilayer printed circuit board according to any of Claims 1 to 6 wherein said conductor circuit is constructed on the resin insulating layer by way of a metal layer composed of at least one metal selected from among the metals (exclusive of Cu) of the 4th to 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn.

8. The multilayer printed circuit board according to any of Claims 1 to 6 wherein said metal layer is disposed on a flat and level resin insulating layer.

9. The multilayer printed circuit board according to any of Claims 1 to 8 wherein said resin insulating layer has a surface obtained by plasma treatment or corona discharge

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treatment.

10. The multilayer printed circuit board according to any of Claims 1 to 9 wherein said substrate board is a board
5 carrying the conductor circuit on its surface or inside.

11. A multilayer printed circuit board comprising a substrate board and, as built up on said substrate board successively and alternately, a conductor circuit and a resin
10 insulating layer at a plurality of levels, with said conductor circuits being interconnected by way of via holes, wherein said resin insulating layer comprises a cycloolefin resin.

12. The multilayer printed circuit board according to Claim 11 wherein said dielectric constant of said resin insulating layer at 1 GHz is not more than 3.0 and the dielectric
15 loss tangent of the same layer is not more than 0.01.

13. The multilayer printed circuit board according to Claim 11 or 12 wherein said cycloolefin resin is a homopolymer or copolymer of 2-norbornene, 5-ethylidene-2-norbornene and/or any of their derivatives.
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14. The multilayer printed circuit board according to any of Claims 11 to 13 wherein said cycloolefin resin is a thermosetting cycloolefin resin.
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15. A process for manufacturing a multilayer printed circuit board comprising a substrate board and, as built up on said substrate board successively and alternately, a conductor circuit and a resin insulating layer at a plurality of levels with said conductor circuits being interconnected by way of via holes,
30 which comprises laminating a film comprising cycloolefin resin
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on a conductor circuit formed on said substrate board by press lamination of an interlayer resin insulating layer under vacuum or reduced pressure.

5 16. The process for manufacturing a multilayer printed circuit board according to Claim 15 wherein the interlayer resin insulating layer composed of a cycloolefin resin is formed on the conductor circuit formed on the substrate board and then openings for via holes are formed in said interlayer resin
10 insulating layer by irradiation with a laser beam.

15 17. A multilayer printed circuit board comprising a substrate board carrying a lower-layer conductor circuit and as built up thereon successively and alternately, an interlayer resin insulating layer and an upper-layer conductor layer, which further comprises a metal layer composed of at least one metal selected from among nickel, cobalt, tin and noble metals as formed at least on the surface of said lower-layer conductor circuit and a roughened layer composed of Cu-Ni-P alloy as
20 formed on said metal layer.

25 18. The multilayer printed circuit board according to Claim 17 wherein said interlayer resin insulating layer is provided with via holes, said via holes being electrically connected to said lower-layer conductor circuit formed on the substrate board by way of said metal layer composed of at least one metal selected from among nickel, cobalt, tin and noble metals and said roughened layer.

30 19. The multilayer printed circuit board according to Claim 17 wherein said roughened layer is covered with a metal layer containing at least one metal having the ionization tendency higher than copper but not higher than titanium or a noble metal layer.
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20. The multilayer printed circuit board according to Claim 17 wherein said via holes are filled with a plated film.

21. A process for manufacturing a multilayer printed circuit board which comprises forming a resin insulating layer and a conductor circuit on a resin substrate, which further comprises forming a metal layer composed of at least one metal selected from among the metal elements of the 4th through 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn on the surface of said resin insulating layer, then cleaning the surface of said metal layer with an acid and thereafter constructing the conductor circuit on said metal layer.

22. The process for manufacturing a multilayer printed circuit board according to Claim 21 wherein said at least one metal selected from among the metal elements of the 4th through 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn is at least one metal selected from among Ni, Cr, Mo, Ti, W, Cu, Al, Sn, Pt, Pd and Au.

23. The process for manufacturing a multilayer printed circuit board according to Claim 21 wherein said resin insulating layer has a flat and level surface.

24. The process for manufacturing a multilayer printed circuit board according to Claim 21 wherein said acid is an acid selected from among hydrochloric acid, sulfuric acid, acetic acid and phosphoric acid or a mixture of such acids.

25. A multilayer printed circuit board comprising a resin substrate board carrying a resin insulating layer on both sides thereof and a conductor circuit built on said resin insulating layer, wherein said conductor circuit has been formed on the surface

of said resin insulating layer by way of a metal layer composed of at least one metal selected from among metals (exclusive of Cu) of the 4th through 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn.

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26. The multilayer printed circuit board according to Claim 25 wherein said metal layer is a layer containing at least one metal selected from among Al, Fe, W, Mo, Sn, Ni, Co, Cr, Ti and noble metals.

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27. The multilayer printed circuit board according to Claim 25 wherein said resin insulating layer has a flat and level surface.

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28. The multilayer printed circuit board according to Claim 25 wherein said resin insulating layer comprises a thermosetting polyolefin resin or a thermoplastic polyolefin resin.

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29. The multilayer printed circuit board according to Claim 25 wherein said resin insulating layer has a surface obtained by plasma treatment or corona discharge treatment.

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30. The multilayer printed circuit board according to Claim 25 wherein said conductor circuit has a metal layer composed of at least one metal selected from among metals (exclusive of Cu) of the 4th through 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn on its surface and said metal layer has an interlayer resin insulating layer or a solder resist layer as built thereon.

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31. The multilayer printed circuit board according to Claim 25 wherein said metal layer built on the surface of said resin insulating layer has a Cu layer formed on its surface and

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said Cu layer has a conductor circuit constructed thereon.

32. The multilayer printed circuit board according to Claim 25 wherein the thickness of said metal layer is 0.01 to 5 0.2 μm .

33. A multilayer printed circuit board comprising a resin substrate board and as built up on both sides thereof, a lower-layer conductor circuit with the conductor circuits 10 interconnected by plated-through holes, an interlayer resin insulating layer formed on said lower-layer conductor circuit, and an upper-layer conductor circuit formed on said interlayer resin insulating layer, wherein said lower-layer conductor circuit is, on at least part 15 of the surface thereof, provided with a metal layer composed of at least one metal selected from among the metals (exclusive of Cu) of the 4th through 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn.

34. The multilayer printed circuit board according to Claim 33 wherein said metal layer is formed from at least one metal selected from among Al, Fe, W, Mo, Sn, Ni, Co, Cr, Ti and noble metals. 20

35. The multilayer printed circuit board according to Claim 33 wherein said resin insulating layer is composed of a thermosetting polyolefin resin or a thermoplastic polyolefin resin. 25

36. The multilayer printed circuit board according to Claim 33 wherein said interlayer resin insulating layer has a flat and level surface with an average roughness value of Ra being not more than 1 μm . 30

37. A process for manufacturing a multilayer printed 35

circuit board which comprises forming a conductor layer on both sides of a resin substrate board, disposing a plating resist according to a designed circuit pattern on said conductor layer, forming a plated film in the area not covered with the plating resist, removing said plating resist, etching the conductor layer under said plating resist to provide a lower-layer conductor circuit, forming an interlayer resin insulating layer over said lower-layer conductor circuit and forming an upper-layer conductor circuit by way of the interlayer resin insulating layer on the lower-layer conductor circuit wherein, after forming said plated film in said area not covered with the plating resist, a metal layer composed of at least one metal selected from among the metals (exclusive of Cu) of the 4th to 7th periods in Group 4A through Group 1B of the long-form periodic table of the elements, Al and Sn is formed on at least part of the surface of said plated film.

38. A process for constructing a conductor circuit which comprises at least the following three steps (1) to (3):

- (1) a step of constructing a first conductor layer composed of a metal forming a passivation film on surface on an insulating substrate board,
- (2) a step of constructing a second conductor layer composed of a metal having the ionization tendency lower than said metal forming a passivation film on surface on said first conductor layer, and
- (3) a step of performing selective etching with an acid etching solution to simultaneously etch off the first and second conductor layers in the non-conductor circuit-forming region.

39. The process for constructing a conductor circuit according to Claim 38 wherein said metal forming a surface passivation layer is at least one metal selected from among Ni, Co, Cr, Ti, Nb, Ta and Al.

40. The process for constructing a conductor circuit according to Claim 38 wherein said metal forming a surface passivation metal is Ni and said second conductor layer composed of a metal having the ionization tendency lower than Ni is a layer composed of at least one metal selected from among Cu, Sn and Pb.

41. The process for constructing a conductor circuit according to Claim 38 wherein said metal forming a passivation film on surface is Al and said second conductor layer composed of a metal having the ionization tendency lower than Al is composed of at least one metal selected from among Cu, Sn, Pb and Fe.

42. The process for constructing a conductor circuit according to any of Claims 38 to 41 wherein said acid etching solution is an aqueous solution of sulfuric acid, an aqueous solution of hydrogen chloride or an aqueous mixed solution of sulfuric acid and hydrogen peroxide.

43. A process for manufacturing a multilayer printed circuit board comprising forming a resin insulating layer and a conductor circuit on an insulating substrate board, which comprises at least the following steps (1) to (5):

- (1) a step of constructing a first conductor layer composed of a metal forming a surface passivation layer on the resin insulating layer,
- (2) a step of constructing a second conductor layer composed of a metal having the ionization tendency lower than said metal forming a passivation film on surface on said first conductor layer,
- (3) a step of disposing a plating resist on said second conductor layer,
- (4) a step of constructing a third conductive layer by electroplating on said second conductor layer provided with

said plating resist, and

(5) after removal of the plating resist, a step of simultaneously etching the first and second conductor layers under said plating resist with an acid etching solution.

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44. The process for manufacturing a multilayer printed circuit board according to Claim 43 wherein said metal forming a passivation film on surface is at least one metal selected from among Ni, Co, Cr, Ti, Nb, Ta and Al.

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45. The process for manufacturing a multilayer printed circuit board according to Claim 43 wherein said metal forming a passivation film on surface is Ni and said second conductor layer composed of a metal having the ionization tendency lower than Ni is a layer composed of at least one metal selected from among Cu, Sn and Pb.

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46. The process for manufacturing a multilayer printed circuit board according to Claim 43 wherein said metal forming a passivation film on surface is Al and said second conductor layer composed of a metal having the ionization tendency lower than Al is a layer composed of at least one metal selected from among Cu, Sn, Pb and Fe.

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47. The process for manufacturing a multilayer printed circuit board according to any of Claims 43 to 46 wherein said acid etching solution is an aqueous solution of sulfuric acid, an aqueous solution of hydrogen chloride or an aqueous mixed solution of sulfuric acid and hydrogen peroxide.

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48. A method of forming a metal film which comprises removing an oxide film on the surface of a nickel film using an aqueous solution of a reducing acid having a concentration of 2.0 to 10.0 mol/L and then forming a different metal film on the surface of said nickel film.

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49. The method of forming a metal film according to claim 48 wherein said aqueous solution of a reducing acid is hydrochloric acid or hydrofluoric acid.

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50. The method of forming a metal film according to Claim 48 or 49 wherein the concentration of said reducing acid solution is 4.0 to 8.0 mol/L.

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51. A process for manufacturing a multilayer printed circuit board which comprises (1) a step of forming an interlayer resin insulating layer on a substrate board formed with a lower-layer conductor circuit and forming openings for via holes in said interlayer resin insulating layer, (2) a step of forming a metal film on said interlayer resin insulating layer, (3) a step of disposing a plating resist on said metal layer, (4) a step of performing electroplating and then forming a nickel film to construct an electroplated film and a nickel film among said plating resists, (5) a step of removing said plating resist and etching said metal layer under said plating resist to thereby construct an upper-layer conductor circuit and via holes and (6) a step of forming a roughened layer composed of Cu-Ni-P alloy on said upper-layer conductor circuit wherein, following said step (5), the oxide film on the surface of said nickel film is removed with an aqueous solution of a reducing acid having a concentration of 2.0 to 10.0 mol/L.

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52. The process for manufacturing a multilayer printed circuit board according to Claim 51 wherein said aqueous solution of a reducing acid is hydrochloric acid or hydrofluoric acid.

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53. The process for manufacturing a multilayer printed circuit board according to Claim 51 or 52 wherein the concentration of said aqueous reducing acid solution is 4.0 to

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8.0 mol/L.

54. A multilayer printed circuit board comprising a substrate board carrying a lower-layer conductor circuit and, as built up on the substrate board successively and alternately, an interlayer resin insulating layer and an upper-layer conductor circuit in succession, which further comprises a metal layer composed of at least one metal selected from among metals having ionization tendencies not lower than tin but not higher than aluminum and noble metals as formed on the surface of said lower-layer conductor circuit and a roughened layer superimposed on said metal layer.

55. The multilayer printed circuit board according to Claim 54 wherein said at least one metal selected from among metals having ionization tendencies not lower than tin but not higher than aluminum and noble metals is at least one metal selected from among aluminum, chromium, iron, zinc, nickel, cobalt, tin and noble metals.

56. The multilayer printed circuit board according to Claim 54 wherein said roughened layer is a layer composed of Cu-Ni-P alloy.

57. The multilayer printed circuit board according to Claim 54 wherein said interlayer resin insulating layer is provided with via holes, said via holes being electrically connected to said lower-layer conductor circuit constructed on the substrate board by way of said metal layer composed of at least one metal selected from among metals having ionization tendencies not lower than tin but not higher than aluminum and noble metals and said roughened layer.

58. The multilayer printed circuit board according to Claim 54 wherein said roughened layer is covered with a layer

containing one or more metals having ionization tendencies higher than copper but not higher than titanium or a noble metal layer.

5 59. The multilayer printed circuit board according to Claim 54 wherein said via holes are filled with a plated metal.

60. A process for manufacturing a multilayer printed circuit board which comprises constructing a conductor circuit,
10 roughening the conductor circuit to provide a roughened surface, forming an interlayer resin insulating layer over the roughened surface of the conductor circuit and forming openings for via holes in a repeated sequence to construct conductor circuits comprised a plurality of layers isolated by interlayer resin
15 insulating layers, wherein, after forming the roughened surface on the conductor circuit, the oxidation treatment is carried out to provide an oxide film on the entire roughened surface and, thereafter, said interlayer resin insulating layer is constructed.

20 61. The process for manufacturing a multilayer printed circuit board according to claim 60 wherein, after forming the roughened surface on the conductor circuit, the roughened surface is oxidized by heating in the atmospheric air at 80 to
25 200°C for 10 minutes to 3 hours to thereby provide an oxide film on the entire roughened surface thereof.

62. A multilayer printed circuit board comprising a substrate board and, as successively built thereon, a conductor
30 circuit provided with a roughened surface and an interlayer resin insulating layer provided with openings for via holes, said openings for via holes being filled with a conductor, which further comprises an oxide film layer covering the whole surface of the conductor circuit provided with the roughened
35 surface.

63. The multilayer printed circuit board according to Claim 62 wherein the thickness of the covering layer comprising an oxide film is 0.01 to 0.2 μm .

63. The multilayer printed circuit board according to Claim 62 wherein the thickness of the covering layer comprising an oxide film is 0.01 to 0.2 μm .